

Anoura cultrata.

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Anoura Gray, 1838

Anoura Gray, 1838:490. Type species *Anoura geoffroyi* Gray.
Rhinchonycteris Tschudi, 1844:71. Type species *Rhinchonycteris peruviana* Tschudi (=*Anoura geoffroyi* Gray).
Anura Agassiz, 1846:27. Emendation of *Anoura*.
Lonchoglossa Peters, 1869:364. Type species *Glossophaga caudifera* Geoffroy St. Hilaire.
Glossonycteris Peters, 1869:365. Type species *Glossonycteris laesiopyga* Peters.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Phyllostomidae, Subfamily Glossophaginae, Genus *Anoura*. The genus *Anoura* includes the living species *A. caudifer*, *A. geoffroyi*, and *A. cultrata* (see Diagnosis). A key to living species is as follows:

1	First premolar largest of mandibular premolars, blade-like, strikingly different in shape from other lower premolars in occlusal view	<i>Anoura cultrata</i>
	First lower premolar not enlarged or bladelike, similar to other mandibular premolars in occlusal view	2
2 (1)	Interfemoral membrane very narrow, 1.5 to 4 mm wide (about 1.5 to 3 mm in midline), furred dorsally, with a dense fringe of hairs on free margin; forearm length 39 to 48; cranial length 24 to 27; Mexico south to southeastern Brazil and northwestern Argentina, Trinidad, and Grenada	<i>A. geoffroyi</i>
	Interfemoral membrane narrow, 3.5 to 5 mm at midline, wider at level of knees, bearing a few fine hairs forming a thin fringe on free margin; forearm length 34 to 39; cranial length 21 to 25; northern South America south to Peru, Bolivia, and southeastern Brazil	<i>A. caudifer</i>

Anoura cultrata Handley, 1960

Handley's Long-tongued Bat

Anoura cultrata Handley, 1960:463. Type locality "Tacarcuna Village, 3,200 ft., Río Puerto, Darién, Panama" (8°10'N, 77°18'W).

Anoura brevirostrum Carter, 1968:427. Type locality "31 km S Tingo María, 850 m, Huánuco, Peru" (9°32'S, 76°00'W).

Anoura werckleae Starrett, 1969:1. Type locality "6.8 mi S restaurant 'La Georgina' along Interamerican Highway, 2500 m, Cerro de la Muerte massif, Province of San José, Costa Rica" (9°32'N, 83°45'W).

CONTEXT AND CONTENT. See generic account above. No subspecies have been recognized (see Nagorsen and Tamsitt, 1981).

DIAGNOSIS. Some distinctive features of the species are indicated in the key above. *A. cultrata* is sympatric with *A. geoffroyi* and *A. caudifer* but differs from these species by the enlarged upper canines, the enlarged bladelike first lower premolar, and the reduced size of the other premolars, both upper and lower. The geographic distribution of these species overlap, but because of pronounced geographic variation in size, diagnostic features relating size in one region may not be diagnostic in another.

Husson (1962), Sanborn (1933), Taddei (1975), and Tamsitt and Valdivieso (1966) compared and characterized *A. geoffroyi* and *A. caudifer* (=*Lonchoglossa caudifer*), and Handley (1960) compared *A. cultrata* and *A. geoffroyi*. In *A. geoffroyi* and *A. cultrata* the interfemoral membrane is triangular in shape and reduced to a narrow, densely-furred band, whereas in *A. caudifer* the interfemoral membrane is semicircular in shape, wider than in *A. cultrata* and *A. geoffroyi*, and sparsely haired. Such other characters given by these authors as the calcar rudimentary, the absence of a tail, and incomplete ossification of zygomatica in *A.*

geoffroyi warrant study before they are accepted as diagnostic characters.

Anoura cultrata differs from *A. geoffroyi* by having a thicker rostrum, the pterygoids more inflated posteriorly, the symphyseal region of the mandibles shortened, and the trough between the lower canines deeper and broader (Handley, 1960). Other characters given by Handley (1960) for *A. cultrata* are of less diagnostic value and subject to individual variation—for example, braincase more tapering anteriorly, posterior margin of the palate more deeply incised beside the posterior palatal extension, presence of a low process anterior to the angular process on the ventral edge of the mandible, highest point of *pl* in the posterior half of the tooth, and dorsal coloration as shiny blackish. *A. cultrata* is similar in size and almost indistinguishable from *A. geoffroyi* externally, but in southern Colombia and Peru *A. cultrata* may be slightly smaller. Extremes of measurements (mm) of *A. cultrata* and *A. geoffroyi* from Peru are, respectively: total length, 57 to 64, 61 to 71; length of forearm, 38 to 43, 41 to 45; and greatest length of skull, 23.0 to 24.4, 24.3 to 26.6.

Anoura caudifer is distinguished from *A. cultrata* by the wider, semicircular-shaped, sparsely-haired interfemoral membrane. *A. caudifer* is also smaller than *A. cultrata*, although in the southern part of the range of *A. cultrata* they approach each other in size. Extremes of measurements (mm) of *A. caudifer* from Peru are: length of forearm, 35 to 37; and greatest length of skull, 21.8 to 23.2.

The skull and lower jaw of *A. cultrata* are illustrated in Fig. 1, and a photograph of the head and tongue is reproduced in Fig. 2.

GENERAL CHARACTERS. For descriptions see Carter (1968), Handley (1960), Nagorsen and Tamsitt (1981), Starrett (1969). Other general characteristics of the genus were summarized by Phillips (1971) and Sanborn (1933). Variation in color of pelage of a large series of specimens from Ibagué, Tolima, Colombia, indicates polymorphism. Dorsal pelage varies in color from Blackish Brown, Fuscous-Black and Fuscous to Mummy Brown and Prout's Brown or Snuff Brown, Sayal Brown, and Buckthorn Brown (capitalized color terms from Ridgway, 1912), darker in specimens from Panama and Venezuela and paler in those from Peru but with considerable individual variation. Individual dorsal hairs are whitish or grayish-white basally, dark brown or brownish-orange distally, and white-tipped, resulting in a tricolored appearance. The pelage of the dorsum is dense, and hairs of the back and rump are slightly longer (7 to 8 mm) in Peruvian specimens and slightly shorter (6 to 7 mm) in Panamanian and Costa Rican specimens. The ventral pelage is pale brown or light tan, paler than the dorsum, and individual hairs are tricolored, the pale tip longer than on the dorsum. The forearm is furred dorsally on the proximal one third, the short (1 to 2 mm) individual hairs reddish to dark brown with pale tips. The propatagium is furred to the same level as on the forearm, and the endopatagium has hairs to a line reaching from the elbow to the knee. The tibia dorsally is heavily furred with reddish-brown hairs 3 to 4 mm long, the length of the hairs decreasing distally. The narrow uropatagium (2.5 to 4 mm wide at tail, wider at knees) is densely fringed with reddish-brown hairs, 3 to 5 mm long at the midline, and the tips of the hairs are frosted in some individuals. The calcar is short (3.5 to 5 mm in length) but distinct. Hairs at the bases of the toes are sparse, short (1 mm or less), and reddish-brown in color. The wing and interfemoral membranes are black, blackish-brown, or dark brown, whereas the ears are gray or grayish-black and darker toward the medial and lateral margins. The tragus is black, pale gray, or light brown, usually darker at the tip, and the noseleaf is black, blackish brown, or dark gray (Nagorsen and Tamsitt, 1981).

Males are slightly larger than females, and the most important variables from discriminant analysis to separate the sexes are condylobasal length, width between upper canines, and length of the first upper molar. Clinal variation in size exists in

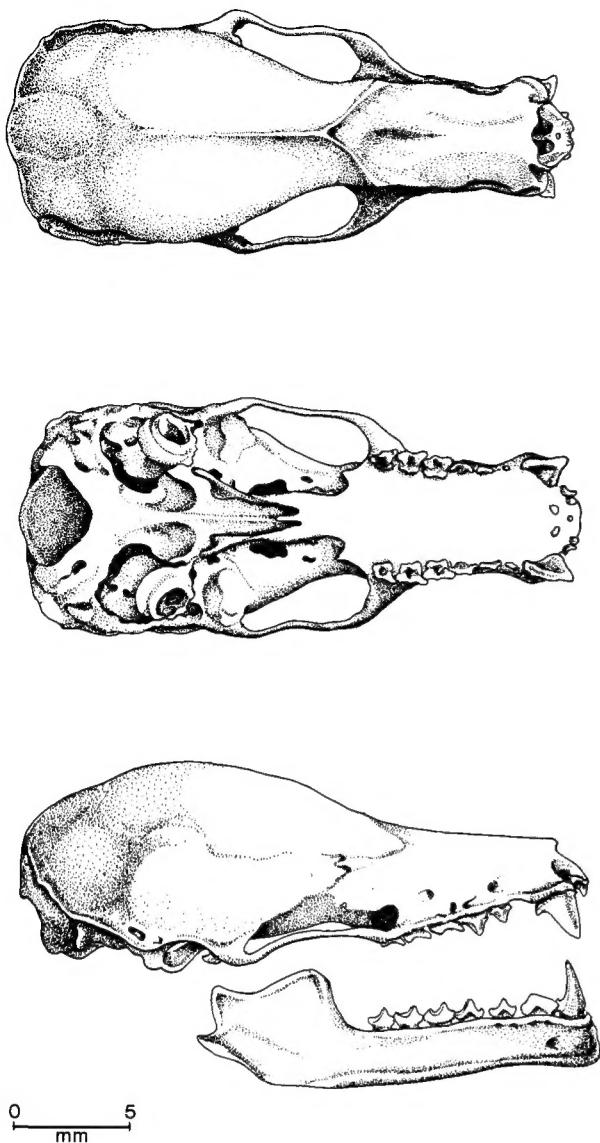


FIGURE 1. Dorsal, ventral, and lateral views of skull and lateral view of mandible of *Anoura cultrata* (ROM 77302 female) from 5.5 km SE Ibagué, Dept. Tolima, Colombia.

this species, and size increases northward, with the smallest individuals of both sexes occurring in Peru and southern Colombia and the largest in Panama and Costa Rica (Nagorsen and Tamsitt, 1981).

External and cranial measurements in mm (mean \pm 2 SE, range, and n) of northern populations from Costa Rica and western Panama are: total length, 77.5 ± 1.44 (74 to 81) 10; length of foot, 13.5 ± 0.86 (11 to 15) 11; length of ear, 15.9 ± 0.58 (14 to 17) 12; length of forearm, 42.8 ± 0.64 (40.7 to 44.1) 10; length of third digit metacarpal, 44.2 ± 0.68 (42.5 to 46.1) 10; length of first phalanx, third digit, 14.2 ± 0.54 (12.4 to 15.3) 10; length of fifth digit metacarpal, 37.0 ± 0.68 (35.5 to 38.6) 10; length of first phalanx, fifth digit, 8.3 ± 0.34 (7.4 to 8.9) 10; greatest length of skull, 25.9 ± 0.20 (25.4 to 26.3) 10; condylobasal length, 25.2 ± 0.18 (24.8 to 25.8) 10; mastoid width, 10.5 ± 0.14 (10.2 to 10.8) 10; width of braincase, 9.9 ± 0.10 (9.6 to 10.0) 10; depth of braincase, 7.8 ± 0.08 (7.5 to 8.0) 10; postorbital constriction, 4.9 ± 0.08 (4.8 to 5.2) 10; width across upper molars (M3–M3), 6.1 ± 0.10 (5.9 to 6.3) 10; length of maxillary toothrow, 9.2 ± 0.08 (9.0 to 9.4) 10; length of mandible, 17.6 ± 0.20 (17.1 to 18.1) 10; length of mandibular toothrow, 9.7 ± 0.12 (9.5 to 10.2) 10; length of p1, 1.8 ± 0.04 (1.7 to 1.9) 10.

External and cranial measurements (statistics in the same sequence as above) of southern populations from Peru are: total



FIGURE 2. Face and venter of an adult *Anoura cultrata* with tongue extended. Courtesy of Thomas O. Lemke.

length, 61.6 ± 1.15 (57 to 63) 11; length of foot, 12.2 ± 0.43 (11 to 14) 17; length of ear, 13.6 ± 0.45 (12 to 15) 16; length of forearm, 39.9 ± 0.58 (38.4 to 42.7) 15; length of third digit metacarpal, 41.4 ± 0.70 (38.7 to 43.9) 15; length of first phalanx, third digit, 13.1 ± 0.32 (12.4 to 14.1) 15; length of fifth digit metacarpal, 34.4 ± 0.60 (32.6 to 36.0) 15; length of first phalanx, fifth digit, 7.7 ± 0.30 (7.0 to 8.7) 15; greatest length of skull, 23.5 ± 0.22 (23.0 to 24.4) 15; condylobasal length, 22.7 ± 0.24 (22.0 to 23.7) 15; mastoid width, 9.7 ± 0.12 (9.2 to 10.1) 15; width of braincase, 9.2 ± 0.08 (9.0 to 9.5) 15; depth of braincase, 7.3 ± 0.08 (7.0 to 7.7) 15; postorbital constriction, 4.7 ± 0.10 (4.4 to 5.0) 15; width across upper molars (M3–M3), 5.6 ± 0.08 (5.4 to 5.9) 15; length of maxillary toothrow, 8.0 ± 0.08 (7.8 to 8.2) 15; length of mandible, 15.7 ± 0.16 (15.3 to 16.4) 15; length of mandibular toothrow, 8.6 ± 0.12 (8.2 to 9.0) 15; length of p1, 1.5 ± 0.04 (1.4 to 1.6) 15.

Weights in g (mean, range, and n) of adults from specimen labels and published data are: males, 17.1 (14.0 to 22.9) 48; non-parous females, 15.0 (11.0 to 19.0) 30; lactating females, 16.6 (14.4 to 17.9) 5; pregnant females, 14.8 (14.0 to 16.0) 4. The weight of a pregnant female that gave birth to twin male fetuses was 21.6 g.

Free caudal vertebrae number four, with a fifth represented by a cartilaginous rudiment attached to the fourth. Although short, the tip of the tail is often noticeable as a medial protuberance at the distal edge of the uropatagium.

The dental formula is $i\ 2/0, c\ 1/1, p\ 3/3, m\ 3/3$, total 32. Shape and size of individual teeth vary considerably (Nagorsen and Tamsitt, 1981), and of 154 specimens, 17 (11.0%) had dental anomalies. Most observed abnormalities involved missing teeth, primarily the right or left P2 or p2, although in one male both P2 and the right p2 were missing, and in another male both p2 were absent. In another male both M3 were missing. Teeth frequently are lost in life in species of *Anoura*, and a high incident of loss of the first premolars (P1, p1) is due to periodontal disease caused by macronyssid mites (Phillips, 1971). In one female right and left M1 and the left M2 are missing, the crown of the left m2 has been fractured and shed, carious lesions are evident in the crowns of both m1, and wear on crowns of both P2 is pronounced. Instances of hyperdontia or dental agenesis are not known (Phillips, 1971).

For illustrations see Hall (1981:127, 128, Figs. 90, 92—drawings of dorsal, ventral, and lateral views of crania), Starrett (1969:4, 5, Figs. 1 and 2—dorsal views of crania, drawings of the posterior palate and basisphenoid region), and Walker et al. (1975:288—ventral view of bat, lateral view of head, and view of tongue).

DISTRIBUTION. The species inhabits montane regions of the neotropics from Costa Rica southward to Bolivia (Fig. 3). The northernmost record is Vara Blanca ($10^{\circ}10'N$, $84^{\circ}09'W$), Prov. of Heredia, Costa Rica, and the southernmost record is Serranía Bellavista, 47 km by road north of Caranavi ($15^{\circ}38'S$, $67^{\circ}32'W$), Depto. of La Paz, Bolivia. Locality records of *A. cultrata* were summarized by Nagorsen and Tamsitt (1981), and records were given by Carter et al. (1966), Gardner et al. (1970), LaVal (1977), and Starrett (1969) for Costa Rica; by Handley (1960, 1966) for

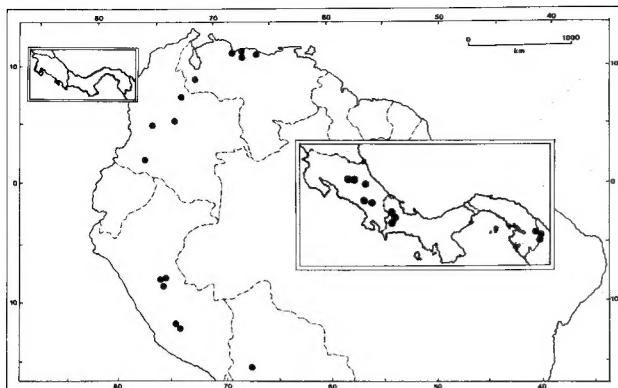


FIGURE 3. Known records of occurrence of *Anoura cultrata* in Central and South America. Modified from Nagorsen and Tamsitt (1981:84, Fig. 1).

Panama; by Carter (1968) and Lemke and Tamsitt (1979) for Colombia; by Baldini (1979), Handley (1976), and Ojasti (1966) for Venezuela; by Carter (1968) and Koopman (1978) for Peru, and by Anderson et al. (in press) for Bolivia. Exact limits of distribution are difficult to determine because of paucity of specimens. *A. cultrata* is not presently known from Ecuador, but populations probably occur throughout mountainous regions of northern South America where suitable roosting sites are available.

FORM. Forman (1968) described the morphology of spermatozoa of *A. cultrata* from Panama, and Forman and Genoways (1979) summarized his results as follows: "Head rounded, its breadth approximately seven-eights of length, broadest in basal region, bluntly rounded at apex; base slightly concave Mid-piece short when compared to length of tail; width uniform throughout."

Smith and Starrett (1979) discussed morphometrics of the wings of *A. cultrata*, *A. geoffroyi*, and *A. caudifer*. Glossophagine bats have short wings as compared to other phyllostomids; the length of the forearm averages more than half (63%) the length of head and body. The overall aspect ratio of the wings of glossophagines is highest for the family and in *Anoura* averages 6.5 (6.23 to 6.74).

ONTOGENY AND REPRODUCTION. Lemke and Tamsitt (1979) and Nagorsen and Tamsitt (1981) summarized reproductive data of this species. In Costa Rica, a female taken on 29 August contained a fetus 28.5 mm long (Gardner et al., 1970). In west central Colombia, two *A. cultrata* aborted full-term fetuses (crown-rump length 20.0, 21.3 mm) on 17 July, and lactating females were found on 30 and 31 July (Lemke and Tamsitt, 1979). In southwestern Colombia, three females collected on 10 August each contained a single embryo (11 to 14 mm crown-rump length) (Lemke and Tamsitt, 1979). In Peru, lactating females were taken on 16 and 21 August (Carter, 1968; specimen label). Although *A. cultrata* usually bears a single offspring, at Ibagué, Colombia, on 30 July, a female (21.6 g) gave birth to twin males (Lemke and Tamsitt, 1979). Measurements (mm) and weights (g) of the neonate males were: total length, 42, 35; length of forearm, 22.9, 18.0; weight, 3.7, 3.0.

Males with enlarged testes (6 mm or greater in length) were taken in Costa Rica in February, May, and July; in Panama in February; and in Colombia in May, July, and early August. Testes of males taken in March and April in Venezuela and in late August in Colombia and Peru were smaller (1 to 4 mm in length) than those taken in other months. No other reproductive data are available.

ECOLOGY. Comprehensive studies on the ecology of this bat have not been undertaken, but natural history information may be obtained from Carter (1968), Carter et al. (1966), Gardner et al. (1970), Handley (1966, 1976), Lemke and Tamsitt (1979), Ojasti (1966), and Starrett (1969). Most information here was summarized by Nagorsen and Tamsitt (1981). This species has a wide altitudinal distribution and occurs from 220 m in lowland forests of Venezuela to 2,600 m in montane rain and cloud forests of Costa Rica, Colombia, and Peru. Specimens have been collected at elevations from 600 to 2,260 m in Peru, at 1,350 m in Bolivia,

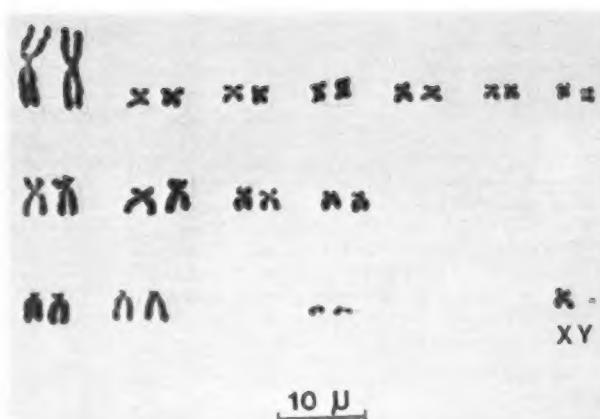


FIGURE 4. Karyotype of a male *Anoura cultrata* (ROM 77267) from 5.5 km SE Ibagué, Dept. Tolima, Colombia.

220 to 1,970 m in Venezuela, 1,044 to 2,590 m in Colombia, 732 to 2,600 m in western Panama and Costa Rica, and 540 to 1,250 m in eastern Panama. Of the 31 localities known for the species, 25 (81%) occur in premontane and lower montane life zones (524 to 1,900 m), two (6.4%) in the tropical zone at altitudes less than 500 m, and four (12.9%) above 2,000 m in montane zones. Most localities are in moist, wet, rain or cloud forests characterized by a mean annual precipitation of 1,100 to 8,000 mm and by a mean annual temperature range of 12°C to 24°C (Holdridge, 1947). Habitats in premontane and lower montane life zones from which *A. cultrata* have been collected are characteristically evergreen cloud or rain forests, and of 134 specimens, 56 (41.8%) are from moist forests, 36 (26.9%) from wet forests, and 28 (20.9%) from rain or cloud forests. Only 14 specimens (10.4%) were collected in seasonal dry forests, all in Venezuela.

Netting sites include various habitats. In Costa Rica, specimens were netted near mountain streams in evergreen forest, in tall grass in open areas, in nets between canyon walls and a river, in wet forest cleared for agriculture, in a montane rain forest along the crest of a mountain ridge, and along and across trails in forests. In Panama, specimens were taken in nets set in evergreen forests, and in Venezuela they were netted under guava trees (*Psidium* sp.) on a lawn, over rivers and streams, and in a cloud forest. In Peru, specimens were netted in cut-over rain forest with secondary growth and in a cloud forest, and in Colombia they were collected from roosting sites or in nets in adjacent cloud or moist forest.

Known roosting sites without exception are in natural caves or man-made equivalents, and are often associated with oil birds (*Steatornis caripensis*) and other species of bats. In Norte de Santander, Colombia, specimens were collected near Gramalote from a small cave in which oil birds roosted and from a natural cave near Bochalema. In Tolima, Colombia, they were taken from immense abandoned railroad tunnels in which thousands of bats roosted, including *A. caudifer*, *A. geoffroyi*, *Carollia* sp., and *Pteronotus parnellii*. In Huila, Colombia, they were collected near the exit and inside the huge Cueva del Indio, in which oil birds roosted. *A. geoffroyi*, *Vampyrops aurarius*, *Carollia brevicauda*, and *Myotis oxyotis* also occurred in the cave, and *A. caudifer* was netted in the forest above the entrance of the cave (Lemke and Tamsitt, 1979). Known roosting sites of *A. cultrata* are limited to caves or tunnels. In areas of sympatry, *A. cultrata*, *A. geoffroyi*, and *A. caudifer* may inhabit the same roosts.

Feeding habits of glossophagine bats of the genus *Anoura* were reviewed by Gardner (1977), who stated that the diet of *A. geoffroyi* and *A. caudifer* consisted of fruit, pollen, nectar, and insects. He also stated that the diet of *A. cultrata* (=*A. brevirostrum*, *A. werckleae*) was not well known but was probably similar to that of *A. geoffroyi*, which is highly insectivorous. Sazima (1976) concluded that the insectivorous behavior of species of *Anoura* should be considered as that of a "foliage gleaner" as defined by Wilson (1973), and Nagorsen and Tamsitt (1981) surmised that bats of this genus feed opportunistically on insects near or on foliage and on nectar and pollen of flowers. Contents of stomachs of four *A. cultrata* from Venezuela included unidentified insects and a creamy liquid. Stomachs of eight specimens from Panama contained yellow, greenish and white or grayish

masses, and two also contained unidentified insects. A specimen from Panama with a white mass in the stomach also had the head covered with pollen. In 18 specimens from Colombia, stomachs contained pollen and plant fibers. The two specimens on which Starrett (1969) based his description of *A. werckleae* had pollen in the pelage, which was identified as the flowering tree, *Hibiscus luteus* (= *Wercklea lutea*). LaVal and Fitch (1977) recorded plants (pollen and nectar) as the food of a specimen from Costa Rica, and Howell and Burch (1964) found moths (Lepidoptera) in the stomachs of six *A. cultrata* from Costa Rica.

Anoura cultrata is parasitized by the spinturnicid wing mites, *Periglischrus caligus* and *P. vargasi* (Furman, 1966; Machado-Allison, 1965), and by the streblid flies, *Anastrebla mattadeni* and *Exastinion oculatum* (Wenzel, 1976; Wenzel et al., 1966). See also Webb and Loomis (1977).

GENETICS. The karyotypes of *A. cultrata* (Fig. 4) and other species (*A. caudifer*, *A. geoffroyi*) have a diploid number of 30 chromosomes (Baker, 1979; Nagorsen and Tamsitt, 1981). Autosomes consist of seven pairs of metacentrics, four pairs of submetacentrics, two pairs of subtelocentrics, and a pair of acrocentrics. The X chromosome is a submetacentric, and the Y chromosome is a minute acrocentric.

The fundamental number was reported to be 54 in specimens from Colombia (Nagorsen and Tamsitt, 1981) and 56 in specimens from Costa Rica (Baker, 1979), but the discrepancy in fundamental numbers may be a result of a difference in interpretation of the morphology of the smallest pair of autosomes, which was considered to be biarmed by Baker (1979) and acrocentric by Nagorsen and Tamsitt (1981).

REMARKS. The synonyms for the genus were adapted from Cabrera (1958) and Hall (1981). Before the revision by Nagorsen and Tamsitt (1981) *A. cultrata*, *A. brevirostrum*, and *A. werckleae* were recognized as distinct species. *A. brevirostrum*, characterized by small size and the absence of a tail, was known only from Colombia and Peru, and *A. werckleae*, distinguished by pelage color and minor dental and cranial characters, was known only in Costa Rica. Nagorsen and Tamsitt (1981), however, described a marked size cline, with the smallest individuals occurring in Peru and the largest in Costa Rica and Panama. They also found tails in Peruvian specimens and great variation in qualitative cranial characters that distinguished the taxa. Moreover, a large series of specimens from Ibagué, Colombia, demonstrated such variation in pelage color as to suggest polymorphism. Consequently Nagorsen and Tamsitt (1981) considered the three taxa to be conspecific. Subspecies in *A. cultrata* were not recognized by Nagorsen and Tamsitt (1981) because variation in size is continuous and no obvious geographic trends exist in color of dorsal pelage.

The generic name *Anoura* is formed from the Greek *an* (without) and *oura* (tail) and refers to the small or rudimentary tail. The specific name *culturata* is from the Latin *culturatus* (knife-shaped) and alludes to the large, bladelike first lower premolar of this species. The common name "Handley's tailless bat" given by Hall (1981) for *A. cultrata* is inappropriate, for although short, a distinct tail is present in this species.

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